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WEST EUROPE REPORT

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INTERNATIONAL AFFAIRS

EEC AID TO OFFSHORE TECHNOLOGY

Paris L'INDUSTRIE DU PETROLE GAZ-CHIMIE in English Apr 80 pp 81-89

[Article by Eric Meyer]

[Text]

Some months ago, in this magazine (1), we analysed the action taken by the EEC to encourage technological offshore research. Since 1973, it has been providing up to 40 % of the necessary capital for certain projects concerning offshore development of drilling equipment and techniques, exploration, transport and storage of hydrocarbons. After five years of operation, the system is proving to be largely positive. According to EEC officials, a large percentage of European offshore technology would not be available today had it not been for the monetary incentives of the EEC.

However, despite its success, the EEC grant system was much less certain of continuing to operate in the future. In European institutions and in the professional milieus concerned, a certain number of voices were being raised to contest the usefulness of research grants.

The symposium of Luxemburg (2)

During the symposium, the European energy commissioner, Mr Guido Brunner was himself of the opinion that "offshore technology for the 1980's is now available", thus implying that the EEC could step down its activities in this field.

It seemed that the stakes were down-offshore research had done its time, and Europe was ready to resort to old an project, designed this time to encourage offshore exploration. But more than a year later, in April 1980, the idea of exploration grants has been consigned to oblivion and the EEC, member states, and the companies concerned are still showing a very lively interest in technological research aid.

The object of this article is to study the events leading up to this change in situation, and to ascertain the direction in which European financing, project orientation, and the criteria for selecting candidates

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1. L'Industrie du Petrole, no. 509, July-August 1979, pp 14-23, "The EEC aid to technological research in the field of hydrocarbons," test in English and French.

2. 18th to 20th April 1979, in Luxemburg, see L'Industrie du Petrole, no. 505, April 1979, p. 5 and no. 506, May 1979, pp 73-75.

from the different countries have developed.

But firstly, the basis characteristics of this system adopted in 1973 a little by chance, should be recalled. The EEC wanted to encourage hydrocarbon exploration but France and Germany were against this. To compensate the countries interested in this type of encouragement, France proposed a grant for technological research. Thus regulation no. 3056/73 was adopted, whereas the EEC's proposal, which had not been officially rejected, followed a curious path through the labyrinths of administration, including the "Greenland decision" in May 1978 (see box) and was the object of a new endeavour to change course a year later.

Regulation no 3056 provides for any "natural or legal person" to present a project, provided they reside within the EEC. In other words, the European oil companies, large building construction companies and small firms specialized in engineering are eligible for grants offered for research into offshore hydrocarbon prospection, production, storage and transport technologies.

Each year, a budget is allocated to this effect and the EEC publishes two calls for tender corresponding to two sections of the grant. After thorough study by EEC experts, the project is accepted or refused by the Council. If it is accepted, the bidders obtain grants covering 25 to 40 % of their costs, to be reimbursed if the project is marketed. A contract is drawn up between the two parties and payments are made in installments over three years. In virtue of these payments, the EEC has the right to carry out fairly strict controls on the worksites, in order to check that the funds are being properly used.

The EEC's decision obviously depends on the number and quality of the projects presented, but one of the criteria is also the type of results sought by the EEC. The "right" project must be truly innovative, practical, correspond to a demand, and be on a fairly large scale. The aim is more to devise technological tools which can be used on a short or medium term basis than to carry out scientific experiments which have no practical applications.

Over five years, from 1973 to 1978, the EEC has paid out over 170 million of European Counting Units (1 ECU = 5.84 FF), corresponding to a little over a third of project costs.

France, most of whose projects are prepared and presented by GERTH (Hydrocarbon Technological Research Economic Group), an economic interest group consisting of Elf, CFP and IFP, has obtained on an average, 35 % of all available funds, followed by Great Britain (30 %), which also has a special office, the Department of Energy. Italy has also received a large share of the grant (16 %), thanks to ENI and its subsidiaries. West Germany, curiously enough, plays a very unobtrusive part (10 % of subsidies), obtained by Deminex.

Apparently, each country has approached offshore technological research from a different point of view, according to its specific economic situation. Using the logic expressed by a popular slogan, "we don't have oil, but we have ideas", France has sought to develop a deepsea technology, for its own use, but also for export and as a means of obtaining alternative energy. Great Britain wants to resolve its oil development problems in the North Sea. Italy is pursuing the same type of practical short-term research, perhaps with the idea of outfitting the oil fields in the Mediterranean and the Middle East.

Criticism from two sources

Threats of the ECC aid system for offshore technological research last year seemed to arise from two sources of criticism. The first, from the European Parliament, attacked offshore grants because the Council that allocates them, and the European Parliament is claiming greater monetary powers (it was the council that came under fire and not the idea of promoting research). The second is without doubt more serious. A highly placed European official responsible for the energy sector, would have been personally irritated had France obtained a lion's share of the aid program and would willingly have reduced the grant so as "not to waste EEC resources".

Despite the condemnation inferred by Guido Brunner during the Luxemburg Symposium, we were of the opinion in our first article that the technological offshore research aid program would not disappear, but be redimensioned to correspond to the new needs which have arisen from the numerous hikes in the price of oil. The follow-up to the events has proved us right.

In the interim, the companies concerned, the governments and EEC institutions have come to support the aid program. For the first time, the EEC has, for example, published the list of companies benefitting from grants within the framework of the first 1979 allocations, in the EEC Official Journal and, at the end of June, will probably publish its second report. Likewise, it has decided to channel 30 million ECU into offshore technology over the next three years, whereas it requested 20 this year and was granted 15, a very low figure with respect to 1977, the "year of plenty" when the figure was 50 million ECU.

Political willingness to give a new impetus to aid

These may seem rather small contributions but they represent a political willingness to give a new impetus to aid.

If the EEC was led to change its attitude towards offshore technological research, it was mainly due to the Luxemburg Symposium. Whereas the Europeans officials came to bury the technological aid plan in favour of exploration, this meeting of experts, both from the EEC and from the companies concerned, meant that the needs not yet covered by present day technology were able to be narrowed down to two main fields — geophysics and enhanced recovery.

The Symposium proved the framework for an unexpected consensus of opinion on the part of EEC officials, research technicians and users, concerning these new needs, and the rather bleak picture presented by oil supplies in the future. For the companies concerned, the result was a renewed interest in the EEC plan, and for the EEC, a revision of its objectives.

However, another event helped accelerate this change of course — the EEC's refusal to assume part of the exploration and prospecting expenses incurred by the oil companies. It should also be noted that the exploration aid project was often poorly presented at the EEC. In this respect, it was not viewed as industrial exploration but rather as preliminary scientific exploration in zones which, on the face of it, were interesting from an oil point of view.

This type of work can be carried out by research institutes without an exclusive mining right being needed. Greenland is a perfect example of this — preliminary exploration work was carried out by the Geological Survey of Denmark.

Strictly speaking, the veto came from two countries, Great Britain and West Germany. The latter, traditionally Europe's treasurer, had no wish to increase its financial burdens by making capital outlays the oil companies are quite capable of assuming themselves, particularly at the moment. As for England, it seems that it was intent on preventing the "continental" countries from prospecting on its own continental shelf. Whatever the reason, by rejecting the proposal for exploration aid a second time, the Council ruled out the alternative to the offshore technology aid program, and thus forced member states to accept it — though only after some modifications.

At Germany's request, a special group checked regulation 3056 and changed certain details concerning fields of application, as well as the terms and conditions for allocating the grants. Since then, emphasis has been on exploration technologies (geophysics) and enhanced recovery.

Bigger and better projects

The Brussels administration may have radically changed its attitude to offshore aid, but the potential beneficiaries of this program have also acquired a different outlook. The figures for project applications alone are proof of this. In 1979, the year of the symposium, 34 projects were presented during the first period and 58 (or 63 according to another count) during the second, which gives a total comparable to the record figure in 1976 : 120 applications.

From a quality point of view, an obvious improvement in the projects can be seen — out of the 34 applications presented during the first half of 1979, 24 were accepted, whereas the 120 projects presented in 1976 shrank considerably in number. Only 36 were finally subsidized and 40 were judged ineligible on the first reading.

The applications presented, also appear to have undergone a "maturing" process, to which GERTH in France and the Department of Energy in Great Britain are no strangers. Since the Luxemburg Symposium, the projects have also changed their emphasis, in favour of geophysics and enhanced recovery, security of installations and subsea work. This was particularly noticeable in projects presented during the second period of 1979, which are currently being studied — eight projects out of 58, i.e. 14 %, are concerned with enhanced recovery and seek one third of the funds necessary! One of them, filed by GERTH, involves a total investment of 220 million francs and concerns a heavy oil recovery program for field deposits.

The total cost of projects in 1979 amounted to the record figure of more than 400 million ECU which is by far the largest investment made by the allied petroleum sector in Europe.

The EEC offshore aid system is thus in a very strange situation in the EEC. Despite its current outlay, which is the lowest since its instigation, the aid program has never known such a lively interest to be taken by professional and European officials.

However, it would be wrong to maintain that criticism of the system has disappeared altogether. A European parliamentarian recently asked the EEC "how it explained the fact that multinational oil companies are presently being granted research funds worth several millions out of the EEC budget". Even if the question is not entirely free of electoral overtones, it is worth asking. Certainly, out of the three categories of users mentioned earlier, the large oil companies and engineering firms each obtain some 40 % of the grants, with the small and medium scale engineering companies disposing of the remainder. Likewise, profits being made by the oil companies at the moment should certainly enable them to meet their own needs with respect to new technology — that is the opinion of the German government in any case.

The Commisssion's reply to this is that the oil companies tend to invest on a short term basis and, without its financial encouragement, they would abandon all research that is not immediately profitable. In short, European aid is a much easier way for oil companies to carry out a very necessary task while at the same time obeying the rules of free enterprise. This is even more true insofar as a large share of the subsidies obtained is given over to companies in the allied oil industry who are acting as subcontractors involved in joint long term research ventures.

Results for the first period in 1979

Country	Number of projects	Grant (in ECU)	in %
France	7	8,299,216	36.9 %
Great Britain	9	5,433,464	24.1 %
Italy	4	6,583,951	29.2 %
West Germany	5	2,212,110	9.8 %
Total	22	22,528,739	

The results of the first section of grants for 1979 are clearly superior to those of the preceding years. While France and West Germany have approximately the same percentages and ranks on the "honours list" for EEC grants, Italy on the other hand, has made a « breakthrough » to the detriment of Great Britain, by obtaining nearly 30 % of funds allocated. Italy and France stand out for their large-scale projects (the SNAM project for self-contained underwater installations for repairing deepsea pipelines requires an investment of 10 million ECU, 30 % of which has been granted by the EEC). This is without doubt the main reason that these two countries have carried off two thirds of European subsidies.

Conclusion

It may be surprising to see a situation undergo such radical transformation in less than a year. However, the rapidly changing character of the EEC offshore file is not surprising, considering that it is subject both to the fluctuations of the world oil market and the economic growth crises in Europe.

The EEC system for offshore technological research aid is assured of survival for a few years yet. It has adapted to the new economic conditions resulting from expensive energy. The techniques of exploration and recovery aim at developing a source of petroleum that has been neglected in the past. When G. Brunner expressed the opinion that *"offshore technology for the 1980's is now available", he was mainly referring to deepwater development techniques.*

The Council's recent decisions mean that the EEC will not finance exploration projects in the near future. However, on a long term basis, this could change. In fact, the oil companies which presently derive more of their profits from optimum utilization of their stocks — which in any case, they must reconstitute — could find themselves in investmement difficulties some day. Europe may then feel the need for an urgent program of systematic prospection, which would perhaps provide an occasion for bringing the EEC exploration aid plan to life again. □

CSO: 3102

FEDERAL REPUBLIC OF GERMANY

SIEMENS OFFERS LINE OF INDUSTRIAL ROBOTS

Frankfurt/Main FRANKFURTER ALLGEMEINE BLICK DURCH DIE WIRTSCHAFT in German 26 Apr 80 p 5

[Article by re: "Robots Service 'Production Islands'"]

[Text] Siemens AG, Munich/Berlin--Whoever is in control of the main time schedule for machine tools and other production machines with numerical controls also wants to shorten the marginal times for changing tools and production goods. For this Siemens is offering electromechanical equipment, called Sirobot, which was especially conceived for machine tools. According to information from Siemens this family of robots ranges from Sirobot 0, which can be attached directly to the machine tool, to Sirobot 1 for double machine operations, to Sirobot 2 for multiple machine operations.

Sirobot 0 is a freely programmable industrial robot for machine tools. According to the company, it provides the possibility for changing working parts goods and tools, as well as for giving certain commands to the machine tools. Two bearing-regulated and two controlled axles enable motions in six degrees of freedom. The direct attachment to the machine tools keeps the amount of space needed within bounds and permits the construction of an unmanned production system. The numerical control system of the machine tools and the controls for the Sirobot can be integrated to form a unit. The maximum weight of the working parts that can be gripped is 10 kilograms. A programming method designed especially for industrial robots enables quick and easy programming.

Sirobot 1 and 2 work in cylinder coordinates. The Sirobot is independent as a result of the integrated microprocessor CNC controls and is connected to the machine tool being operated by means of only a few control signals. During the first procedure, the teach-in control stores the labor steps automatically in buffered semiconductor memories. Subsequent production goods are then fed in and removed automatically with the machine tools performing the same functions. The externally located teach-in control panel contains all the required operating elements and indicates the work being performed on a digital display. Subprograms and special routines also make it possible to program the controls in such a simple way that the Sirobot can process stacked raw materials and then also stack finished products.

Program optimization and program corrections are possible during the test run by means of the teach-in control panel. Diagnosis systems assure quick error location in breakdown cases. The grips, which were designed especially for handling milled and cut parts as well as tools, can grip rotationally symmetrical and rectangular forms reliably with three centripetal, electropneumatically moved fingers. The maximum weight that can be gripped is 20 kilograms. The simple and robust structure also enables exact positioning under conditions of maximum unloading and maximum weight of working parts. Because the Sirobot--with electrical and mechanical parts assembled completed by the manufacturer--runs through a computerized functional test, Siemens maintains that it can be put to work within a few hours.

Autonomous "Production Islands" can be constructed with the Sirobot 1 in combination with one or two machine tools which is the first step on the way towards multiple machine operations. Motions in five sequential axes are possible. Double grips--two production goods simultaneously--considably reduced the time required for loading and unloading the machine tool. Autonomous "production islands" can be constructed with the Sirobot 2 in combination with up to five machine tools. They constitute the economic prestage to a "mini-DNC." Motions in six axes are possible, whereby three axes can be operated simultaneously. A product-to-product freely programmable priority control mechanism assures that bottleneck machinery receives priority during operations.

9527
CSO: 3102

FRANCE-BRAZIL TO BUILD WORLD'S FIRST ALCOHOL HELICOPTER

Paris AFP SCIENCES in French 6 Mar 80 p 20

[Text] Brazil, in cooperation with French firms, will soon be producing the first experimental alcohol helicopter in the world, noted Pierre Pech on 28 February. Mr Pech is the South American delegate for the French firm "L'AEROSPATIALE."

When asked by phone about beginning the operations eighteen months from now, Pech said this would be an optimistic date. An agreement for the production of the aircraft will be signed next month between "HELIBRAS" (a Brazilian enterprise affiliated with "L'AEROSPATIALE") and the French company "Turbomeca," which will build the turbine of the first alcohol helicopter.

According to certain unconfirmed sources, the alcohol helicopter will consume a lot more fuel than a normal aircraft. For the Brazilians, however, mass production of this helicopter is less important than an alternate solution for the future.

Brazil has begun production on and is ready to mass produce cars, trucks, buses, motorcycles and tanks that run exclusively on alcohol.

8571
CSO: 3102

FRENCH INDUSTRIAL ROBOTICS SURVEYED

Development of Robotics

Paris SCIENCES & AVENIR in French Mar 80 pp 52-64

[Excerpts] The realities of industrial labor are repetitive: technology has always tended toward this monotony of tasks. And to better manage this, it established "piecemeal work" according to George Friedman, one of those most studied in the social consequences of automation.

The mechanization of the factory or of our kitchen has taken charge of elementary tasks. Thus, the machine carries out its movements on one plane, with another machine being able to assume the following necessary movements in another plane.

Nevertheless, technical progress and the advent of electricity permitted linking certain operations into already complex sequences. This was the age of chain conveyors and the "transfer machines" used after the war by the Renault Company.

Certain tasks were beyond the capabilities of machines. Mainly because for a long time resorting to machines would have rendered the tasks more costly.

But today social considerations have more weight than they did yesterday and the price of labor keeps climbing while, in relative value, the price of the machine decreases. Therefore, the whole question must be reconsidered.

In addition, technical limitations which used to forbid the mechanization of certain tasks have been overcome. Microelectronics and cybernetics have redefined the problem.

The Renault Company, realizing that its "transfer machines" were not recoverable when the model changes, launched an extensive "robotics" research program in 1974. Many models were created, the most advanced of which are being used in one factory or another and will come into general use in 1980 and 1981.

The most important of these machines welds the elements of automotive bodies together. We have seen several of these in the huge shop where R-18 automotive bodies are assembled in Flins.

A body frame arrives on the conveyor belt. Its very coming sets in motion large tongs which pick up two lateral elements from the stocks where they are stored. And, manipulated powerfully but delicately, these elements are set in the exact position wanted. Up to here there is nothing new in this assembly line.

After this automatic phase, men should become involved. Qualified technicians would then weld the parts together point by point. Now, there are two powerful articulated arms working on each side. Their arm, hand and fingers are applied to a precise point on the body. Sparks crackle: something has been welded. Immediately the arm moves. It knows exactly where to go, 5 or 10 cm farther on to a new welding point. And so on all along the body, even into the most difficult-to-reach places.

Compared to hand labor, there is considerable savings of time. "And the work is more precise, more constant," says J. J. Aton, responsible for the shop.

For some weldings the robot must move around obstacles. These fast, skillful and precise movements surprise us even though Pierre Pardo, Renault's deputy director for automation at Boulogne-Bilancourt, has given us rudimentary explanations.

Given three space coordinates, the robot can reach any point and, given any three angular coordinates, it can work on that point in any direction. In principle, mobility on six axes or "degree of freedom" is thus necessary for the robot to carry out any work whatsoever. But Renault manufactures some "7-axis" robots. Why?

Simply because, given supplementary articulation, the mechanism can reach any point behind an obstacle. It will go around any obstacle by adding a supplementary elbow to its arm.

In reality, the movements of the tool must be defined with an eighth vector since it must not be forgotten that, during all these operations, the body is moving regularly on the conveyor.

This is what the new and spectacular painting robot called "elephant trunk" does. With several articulations and steel cables, its arm performs surprisingly supple movements.

To be sure, a rather similar machine was constructed in Norway by Trallfa some ten years ago. But its paint sprayer and its welding torch have only six essential movements and can only paint objects which are accessible without going around. Here, the smooth three-dimensional movements give the impression of a living being. The animal aspect is strengthened even more because the machine is dressed in a cloth envelope for protection against paint spatters.

How come these movements are so smooth and no longer "mechanical"?...Because these are duly registered human movements, not gear movements. Thus, the welding machine and the painting machine reproduce the acts of their teachers...the recipe for this learning is simple: you take a good technician, if not the best, who has been working on this model for a long time. You give him a sprayer. You make him work normally. Yes, normally, despite the set of light, articulated rods to which the tool is connected. The movements of this set are registered by the linkage system. The latter, in fact, acts on the rods which penetrate more or less and act upon voltage dividers. Thus, electric voltages are registered which permit reconstituting with the same system, but without man, the same spatial movements.

When the automotive body model changes, the new movements necessary to paint the new models will be registered. And, half an hour after having painted the last car of the old series, the machine will tackle the new one.

Such registration of human motion is fundamental to robotics. The jerky and angular movements always associated with robots were due to the deficiencies of the good old mechanics of cam automatons.

We cannot leave out the health aspects of the matter: spray paint is harmful and appropriate protection for the handlers is needed. Now, here, everything goes on without man, in an almost enclosed room.

Thus, it is understandable that for all jobs "in a hostile environment," men will delegate robots which will not be less skillful because they are mechanical, but on the contrary will have the skill of even the best technician. Is not this an upset of the frontiers between the human and the mechanical?

Where is the dividing line between the automaton and the robot? This is not a simple matter of terminology; it is also a matter of technology. The automaton repeats tirelessly one sequence of actions, one same "program," a program which can be modified by man. The robot is a machine having a behavior which more or less adapts to circumstances.

More or less. The whole question lies there. If it is unthinkable to research the "more," we can, in the present technological stage, easily obtain the "less." We have seen how the machines which have demonstrated the principles of cybernetics adapt to circumstances. But, neither the "turtles" nor the "homeostats" have any industrial role.

If we are looking for the dividing line between the automaton and the robot, we must look even further on: we will be able to talk of robots when a gadget stops eternally grinding out the same music box tune and becomes capable of varied responses coming to it from the environment. We will understand the difference by looking at where exactly Renault's research is now.

The automobile industry is basically less suited than others to total automation. In fact, in other industries, for example in that of television, it is possible to organise continuous lines on conveyors while in the automobile industry several variables must be provided for: left or right driving; good, bad or very bad roads; allowance for holes to attach special devices demanded by special countries. Thus, the R5 has 80 variables to be provided for since the vehicle was conceived.

This is how the necessary differentiations are obtained today. On the body framework, a man intervenes: having before him an order from the commercial department, he decides that this chassis will become that model and that other chassis will become another model. And he identifies each one by a hand-written label.

Further down the line, the man who supervises each stage will read the label and know what part corresponds to what body from then on. Then, he will manually order the arrival of the desired part.

A step toward more advanced mechanization is under study. It may not be applied unless the savings in time and manual labor are noticeable. Nevertheless, the principle itself of the method under consideration is particularly interesting.

Identified by some "badge," for example, an ultrasonic one, the chassis itself would order the part it needs, by coming to a station, its signal acting on that part's stockpile. Such a step in automation would lead us from the automaton to cybernetics; no matter how rough a step, it would already represent an adaptation of the acts in the chain to outside circumstances.

No one visiting a factory would detect the change. However, the progress would be fundamental: capable of adapting to the environment, the action would have changed its essence.

Another case where a factory can already show adaptation to circumstances will be seen when Renault implements its latest discovery, revealed at the last Innova exhibition: a machine which grasps various parts presented to it in any position and places each in a very precise position in a machine tool.

The problem is for the machine to recognize the part it needs among all the others and to recognize it in any position in which it might be. It is thus a problem of "form recognition." We will not discuss it here in detail since a recent SCIENCE & AVENIR "paper" was devoted to this subject.*

Let us simple say that a TV camera hangs over the field of operation. Through it, the robot places the part exactly, then guides its tong to grasp it: this being an obvious adaptation to circumstances. Better yet, it identifies the form of the part and rejects one with which we try to trick it. When the part having complex forms rests on one or another face, the robot turns it until it can grasp it in the correct position to be set on the machine tool.

The electronic system which compares the recognized silhouette to one of the memorized silhouettes is extremely precise. It was able to outwit a trap we set for it: by sliding a matchbook under the part, we changed the part's silhouette enough so the camera could no longer recognize it.

If Renault is among the top manufacturers of industrial robots, it is not the only one engaged in this essential path. Because American Unimation machines were being used in the company's factories, its engineers, realizing they [the machines] had limited capabilities, decided to go beyond.

In the same industrial perspective are the ASEA [Swedish General Electric Corporation] machines. Since this company is one of the first in the world in electro-mechanics, it is normal that electrical controls prevail, compressed air being used only to close the grasping tongs.

Another original touch: the automaton is set up at the center of machines to which it distributes the parts, takes them back and transfers them. Since it obeys a computer, since the computer program can be multi-purpose, since the machine tools to which it hands the parts are of a current model, one can see that this solution is practically perfect: the industrialist keeps his machines and buys an automaton whose work can vary according to the manufacture; since we are talking here in terms of small series, even "lots."

The automaton pivots 330°. A first arm moves vertically 80°; a second one turns 360° and can rock 90°. Some machines carry an additional third arm whose circular movements cover 270°. The lightest model can even move on rails. It is thus conceivable that the robot can serve several machines. It takes back the completed part from each machine and, rocking its arm, gives the machine the part it brings. Since it is the act of completion of the machine tool work which commands the coming of the arm carrying the new part, there is no possible jamming, the robot thus adapting itself always to the circumstances.

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*SCIENCES & AVENIR, November 1979.

In this same field of adaptation, an important step was taken in 1979 with the "adaptable robots." Let us assume that a surface to be machined is irregular. The speed of the tool will depend on the significance of the irregularities on that surface. Even the new generation of ASEA automatons does not need to be guided in order to machine a curve: given three straight lines constituting its "envelope" the tool itself traces the desired curve.

For a long time we have been looking at the industrial career of robots, which is well developed. But all this time laboratories and universities have been carrying out studies that prepare the future. Since nothing conclusive has come out of this research, we will discuss it more briefly than we have the machines already in service.

Let us first look at the remote control manipulators that enter radioactive chambers and are guided and controlled through the glass by men. Do they seem irrelevant? No! Progress made on them, their control and their tools is directly applicable to robots.

But France is in a good position in this field too. Saclay's STEPPA [expansion unknown], headed by J. Vertut, has created state-of-the-art devices. The U.S. laboratory in Argonne practically abandoned its research almost 15 years ago and the AEC [Atomic Energy Commission] took them up.

Using radio control, the AEC created the Virgule, equipped with "remote control manipulators of intervention," an underwater manipulator for ERIL [expansion unknown] in collaboration with the National Navy, TOMI (Mobile Intervention Remote Control Operator), MERITE (Entry, Repair and Inspection Modules for Water Piping), which works in the pipes connecting the tank of power plants to the steam generator, and an experimental engine MAM (climb on walls) furnished with outlets.

The works of the Institute of Data Processing and Automation Research [IRIA] and its Spartacus project, which has just been taken to the University of Paris XII at Evry, must be seen in the same perspective. The team directed by J. Guittet works with J. Vertut on the application of the AEC remote control manipulators to usage by the handicapped. The tools are moved by slight movements of the head, an elbow or a foot.

But the IRIA project is called Spartacus, which evokes the liberation of a slave. That is, it aims to liberate the machine from man: for the researchers of this project, everything they are now doing for the quadriplegics will be applied later on to "second generation" robots having sensory organs, and then to "third generation" ones provided with significant computation capabilities.

The CNRS [National Center for Scientific Research] has in Toulouse, within the Paul Sabatier University, its Laboratory of Automation and System Analysis [LAAS]. There, Prof Giralt, of international fame, heads the robotics laboratory. By mentioning the three main operations of the team in charge of the "logic of systems," we will have an idea of their work.

Operation "Control and Architecture of Robots":

The essential results have to do with the control of articulated mechanisms; use of work savers; visual perception through TV applied to the automatic stacking of cubes according to a model.

Operation "Coordination, Decision and Robotics":

The objectives concern most of all the learning and decision-making processes. Currently, the work involves studying the decision center for the Hilare robot.

Operation "New Sensors":

It involves creating position sensors, ultrasonic proximity and guiding systems and tongs. A prototype is under construction which promises to be an important innovation in the field of automatic manipulation, mainly in assembly.

We must also mention the creation by J. Clot of "artificial skin" which promises to be an important element in robots that would acquire touch. That "skin" uses a porous, slightly conductive plastic. When the skin finds a surface, it shrinks, conduction varies locally and that increase is detected by electric circuits.

Also there is another laboratory in the South devoting a large portion of its activities to robotics: the LAM [Montpellier Laboratory of Automation] at the University of Languedoc.

Let us remember first the research devoted to computer studies of polyarticulated mechanisms. The computations automatically give the equations of movement that can be accomplished by the organs and represent graphically the performance of the robot.

But let us remember, even celebrate, the experiment which has just occurred and has not yet been published, created under the direction of Prof Liegeois. Several parts are placed before the robot. It chooses the one whose form it recognizes.

Second phase, more important: having seized the part, the robot takes it where it should, generating a trajectory to where it should, exactly. Third phase, most important: it introduces the part into a hole, measuring the friction, regulating its force to achieve insertion. And, in this last act, attains the utmost ever done by a robot: to assemble parts without any need for precise positioning.

Robotics in France

Besides the research financed by the DGRST [General Delegation for Scientific and Technical Research] and carried out by industrialists and university researchers, here are some teams who work mainly in France on robotics, through their own program.

The Institute of Data Processing and Automation Research [IRIA]. The main project of IRIA in robotics is the Spartacus project, whose team has just been installed at the Paris XII University in Evry.

The Technical Department of Protection Equipment and Dosimetry [STEPD]. This department, at the AEC, is responsible for the study and development of remote control manipulators and robots, (nuclear, underwater, space and industrial).

The Laboratory of Automation and System Analysis [LAAS], of the CNRS [National Center for Scientific Research]. University of Toulouse.

University of Rennes. Institute for Research in Data Processing and Aliatour System [IRISA].

University of Montpellier. Laboratory of Automation.

Department of Automation Study and Research [DERA] of the Study and Research Center of Toulouse (CERT-ONERA [National Office for Aerospace Studies and Research]).

Bureau of Automation, Renault Company (Boulogne-Bilancourt).

University of Lille II. Physiologic Automation Research Group [GRAP].

Automation Laboratory of Besancon. University of Franche Comte.

National Advanced School of Mechanics at Nantes (ENSEM).

INSA [expansion unknown], Lyon.

More on Research

Paris INDUSTRIES & TECHNIQUES in French 28 Feb 80 pp 30-33

[Article by Jacques Houbart]

[Text] The problem of "artificial intelligence" is at the heart of the industrial change we are experiencing. It involves simultaneously the fundamentalists and the automation engineers whose paths converge toward new types of production calling extensively on the man/machine dialogue.

"Artificial intelligence," that reflection of reason that man tries to inscribe in the form of logic into material devices, intervenes at the same time at the level of increasingly adaptable automatons and robots and in the relationship of man and the computer. Today its development assumes major significance in the collection and processing of information as well as in the optimization of energy usage.

Other Keys

Until recently the automation of machiner depended only on the language of mechanical wheels or cable configurations. The electronic revolution and the immense possibilities of programming have permitted, especially since the breakthrough of microprocessors, to insert intelligent processing capabilities into the ultimate stages of system organization.

Nevertheless, our companies are establishing an "economy of dialogue," whether it concerns the bases of information, the decision- or design-assistance systems or the establishment of increasingly adaptable automated processes. This evolution is revealed among researchers--a recent congress organized by the AFCET [expansion unknown] and the IRIA at the Paul Sabatier University (Toulouse, September 1979) took account of considerable progress--as well as in the different industrial branches (Colloquium on the Applications of Automation in Industry, organized under Elec, December 1979). Beyond mechanical configurations, other keys are now being proposed to those responsible for production.

Learning

Speaking at the Toulouse Congress on the Problems of Man-Machine Interface, J. Demartini and F. Gachet (Laboratory of Signals and Systems - LASSY) demonstrated the degree to which the adaptation of machine language to that of man is crucial. To widen the scope of dialogue with the machine, the latter must be increasingly capable of learning. In fact, "until that learning [takes place], useful dialogue is reduced to the smallest of universes. In our case the system will thus determine its own universe, which will be fixed by the machine's shortage of learning means."

One of the essential conditions to provide the machine with the means of learning lies in the improvement of its "system of understanding." From this point of view, J. B. Berthelin and G. Sabah (CNRS - Institute of Programming, Pierre et Marie Curie University) are studying the "automatic understanding of natural language."

"We have created the first stage of a data processing system which understands in a certain way the stories which are told and can thus answer questions, even those involving facts that are not explicit in the story," the designers say.

Comprehension being considered a bundle of simultaneous procedures, "the problem of learning can be tackled by constructing procedures which transform and store these explanations in long-term memories."

A. Marcoux, C. Pomian and J. Vignolle (Laboratory of Languages and Data Processing Systems, Paul Sabatier University) have set up a language for artificial intelligence--"Plasma"-- which will be the basis for a programming system oriented toward robotics. The semantics of "Plasma" is based on the definition of actor and the transmission of messages between actor.

"The operator concept generalizes that of procedure: an operator receives messages and, after processing, sends messages to other operators it chooses...The message-receiving mechanism is based on pattern-matching and the relationship of formal parameters to the matched values." The authors have already written a "Plasma" language interpreter oriented toward applications such as plan generation, formal computations and parallel computations.

Having Senses

Parallel to linguistic acquisition, it is clear that "intelligent" machines must also be given a sensory system as sophisticated and multiplexed as possible. Exhaustive research is being conducted at the same time on the collection and processing of sound data and of images.

At the Paul Sabatier University, the IRIA project of D. Dours, R. Facca and C. Solorabarimanana (CERFIA [expansion unknown] Laboratory, Paul Sabatier University), has come up with a system for recognizing and synthesizing speech in real time.

At the French Institute of Petroleum, Pierre Bois is interested in recognizing self-regressive forms in petroleum research. Thanks to preliminary learning, the monitor being the deposit whose nature is known, it is possible to determine the nature of oil and gas reserves. The decision to drill wells or abandon the extension of a field as a production loss depends in fact on the demarcation of a deposit. This method enables exploitation of images of the subsoil in the form of seismic "sections."

In the factory the introduction of robotics poses the problem of creating systems that recognize and determine the position of mechanical parts and permit their loading on the machine tool. A computerized device that has a camera has been conceived by Mona Tabbara-Lallement and Dominique Masse at the CENG [Grenoble Nuclear Research Center] Laboratory of Electronics and Data Processing Technology [LETI].

As for the autonomous mobile robot called "Hilare," it has a multi-sensory system (M. Briot, J. C. Tlou and G. Bauzil, Laboratory of Automation and System Analysis - LAAS-CNRS, Toulouse). The system consists of a 3-D universal visual device based on a video camera complemented by a laser telemeter, an ultrasonic rangefinder permitting navigation to "the closest" and "in a closed loop," a reference device of the robot's position in a beaconed room using infrared sensors. The vehicle and locomotion systems are completed now, as well as the robot's reference device. A "generator of action plans" is being elaborated.

The "Flexible Shops"

Since the spring of 1978, J. Guittet, responsible for IRIA's "Spartacus" program, had told us about the importance that researchers attach to the development of adaptable robots (see our work "The Electronics of Tommorrow," ATP [expansion unknown], 1978). Even now we can imagine costs of small series in the same size category with costs of large series. The Japanese are working extensively in this direction, foreseeing a tenfold increase in production of robots up to 1985.

In France, at the Elec, Mr Carpentier, president of the automation division of GIMEE [expansion unknown], stressed the interest in automation and "flexible" shops for the PMI [expansion unknown]. Essential in the first stage are the decentralized usage of minicomputer numerical control and small regulating systems. The idea of flexibility in production is all the more necessary from the French point of view because, as Mr Sauvaire, secretary general of ADEPA [expansion unknown] has said, 75 percent of industrial production involves lots of less than 50 parts.

DIELI [expansion unknown] officials stress their interest in automatons that are relatively specialized but flexible enough to permit changing from one production lot to another with minimum costs.

Savings and Automation

In a general way, and the Elec colloquium established this well, automation progress represents essentially the possibility of savings, whether of time, raw materials or energy. For example, in the case of the agricultural-foodstuffs sector, where the country must make a major modernization effort, the contributions of automation can cover four categories (according to Mr Pinck, CGEE [General Electrical Equipment Company]-Alsthom): improvement of productivity; increased manufacturing versatility facing product multiplication, variety and different packaging methods; improvement of quality due to manufacturing consistency and respect of increasingly strict norms; and, finally, materials and energy savings.

In any case, one thing is certain: in coming years international competition in the robotics field will become fierce, and France, while having first-class research teams, will have to make up a definite industrial lag. While our country currently has a thousand robots, the Japanese produce several thousands per year. It is true that often these systems are still quite unpolished, but passing from quantity to quality will certainly be a short-term matter.

Priority Action

Paris SCIENCES & AVENIR in French Mar 80 p 64

[Text] The procedure of "concerted actions" that the CNRS can launch, financially backed up by the DGRST to guide and coordinate research in a particularly important direction is well known. Now there is a new form of cooperation between laboratory and industry: the GRECO, groups of coordinated research.

A first "greco" is currently set up to foster automation and robotics. But the decision for its creation was only taken on 15 December at the last session of the CNRS national committee. Therefore, the formation of the group which has been undertaken under the responsibility of Prof G. Giralt, director of the Laboratory of Automation and System Analysis (LAAS) of Toulouse, has not yet been completed.

However, there are several indicators pointing toward this action. Let us say first of all that it has been undertaken because those responsible for French science are aware that, within ten years, automation techniques will make decisive progress and that France must, therefore, be among the first in this evolution, if not revolution.

Which laboratories will take part? Obviously all the research teams belonging to the CNRS groups which work on these matters. Likewise, those which have already tackled these problems at the AEC, the CNES [National Center for Space Studies], the IRIA [Institute of Data Processing and Automation Research] and the ONERA [National Office for Aerospace Studies and Research]. In brief, the industrial establishments oriented toward research in advanced automation.

Work is expected in four main subjects:

General Robotics: The IRIA, the ONERA and the LAAS, the latter having overall responsibility.

Advanced Remote-Operation: Development of remote control manipulators. Given its experience in the matter, the AEC will be responsible for this group.

Mechanics and Technology: This involves the study of techniques necessary for the other subjects. Nobody will be surprised that the University of Besancon, traditionally a clock-making center, is directing this sector.

Flexible Systems of Production: This is the level of industrial applications. The aim is to obtain automatic systems that can adapt to different production [needs]. Due to its experience in the field, the Renault Company will have a special role within this group.

Let us look especially now at the first subject, since it refers to "general robotics." These are the strong points of research even now in progress:

Advanced controls: Trajectory, speed, force and precision.

Complex manipulations: Operations on moving objects, fittings, multiple assemblies and multi-robot tasks.

Automatic inspection.

Conception of operational systems: Adaptation of the robot structure to the work field.

9341
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CURRENT STATUS OF ELECTRIC-VEHICLE R&D REVIEWED

Paris INDUSTRIES & TECHNIQUES in French 20 Mar 80 pp 36-39

[Article: "Electric Vehicles Soon in the Cities," by Jean-Louis Toumit]

> [Text] Electric vehicles still lack inspiration and their range remains limited. This is due to batteries, but progress in this field will open up new applications. The first beneficiaries: mass transit.

Energy crisis or not, there is periodic talk of the advent of the electric vehicle. As if it did not exist. Now, in several countries it has been present for many years. In Great Britain, 50,000 delivery trucks ensure the delivery of milk. In the United States, several thousand vehicles transport diverse products. In Japan there are about 600. And in France 300 electric dump trucks are used to collect household garbage. Without taking into account storehouse equipment and mini golf-carts in all these countries.

All these vehicles have common advantages: comfort, absence of atmospheric and noise pollution, absence of mechanical vibrations and, often, overall energy efficiency comparable to that of their thermal equivalents. But they also have major inconveniences: curtailed speed and a short range which does not exceed 100 km under the best conditions. This limited range is nevertheless, in certain cases, quite acceptable. In fact, a study of the Transportation Research Institute has shown that the average distance covered daily in city deliveries was 67 km, with 80 percent of vehicles covering less than 80 km. Another sizable handicap also penalizing the electric vehicle: since they are not mass produced, the cost of production per kilometer covered--including amortization and cost of exploitation--is currently 30 percent over that of a similar model with a thermal engine.

All these obstacles, to which is added the need for stations to recharge the batteries, are stopping the break through of the individual electric car today. Certainly the stumbling block is the difficulty of storing electric energy and on-going research is aimed at increasing the amount of power stored in the batteries and the interval between recharges.

New Types of Secondary Electrochemical Generators

Some new types of secondary electrochemical generators--that is, those that do not create energy like the fuel battery, but store it and restore it--have therefore seen the light. Among the high-temperature cells, which combine liquid electrodes with solid electrolytes, the combinations of lithium and iron, lithium and chlorine and sodium and sulphur are being studied or are almost ready for implementation. For these different cells, the problem is the safety of their usage, since, like their name indicates, their operating temperature is high (650°C for lithium-chloride batteries, 300°C for sodium-sulphur ones, whose container is also easily destructible). Their advantages are their high specific energy (2,200 Wh/kg for lithium-chloride), the abundance and rather small cost of their elements (sodium-sulphur) and their capacity to store energy (lithium-sulphur).

Low-temperature cells are the second category of secondary generators. Alkaline type cells (example: nickel-cadmium) are already installed in some industries which value their significant cycle life, regular discharge, acceptance of overcharges and resistance to temperature changes. This type of battery appeals then, especially, to electric power plants, underwater works and also, as we shall see, mass transportation. Despite all the advantages of these new cells, low-temperature lead-acid batteries remain the masters of the situation. First of all because of their anteriority. The production tools exist and mass production is translated into cost price. Thus, an alkaline battery costs today seven or eight times more than a similar lead one. Then, because of its technical evolution. The handicap of the lead-acid battery lies in its heavy weight in relation to capacity. This is the reason why manufacturers in the last few years have sought to lighten it by using polypropylene for the containers, polyvynil chloride for the separators and aluminum for the combs. They have also reduced the antimony rate of the anodes and improved imperviousness to increase efficiency.*

For all these reasons, the lead-acid battery still has a good life before it. Currently it is found in most storehouse engines which have abandoned the nickel-iron cell whose specific energy was weak. Lacking a more efficient solution, it has also been chosen for electric vehicles. Thus, the two prize winners of the recent competition launched by GIVE (Interministerial Group on Electric Vehicles), the Daily Unic (IVECO) delivery truck and the Renault-Tregie (RVI) van, have Fulmen lead batteries. The performance of these two vehicles--tested at the EdF de Renardieres center--reveal the current limits of batteries. Concerning range, the Renault 4 has covered 77 km at 60 km/h non-stop with maximum carrying load and 43 km with 4 stops per kilometer and a 230 kg load. Under the same conditions, the Daily Unic has rolled during 94 and 60 km respectively. As a comparison, it can be said that in 1973-75, the EdF experiments on R4's and R5's led to ranges of 95 km in the highway and 55 km in the city.

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*See INDUSTRIES ET TECHNIQUES, No 405, 20 Sep 79.

Nevertheless, the difficulty of breaking through the 100-km range mark must not be attributed exclusively to battery capacity. It is quite certain that you cannot expect the same performance from a "modified electric" thermal engine vehicle as from an engine especially designed for electricity, but such a vehicle has remained on automobile manufacturers' drawing boards as long as the conventional engine could be fed by a fully opened and relatively cheap petroleum faucet. In the beginning, the energy crisis hastened only the improvement of existing thermal engines.

In this context, the CGE Gregoire prototype, totally conceived as an electric vehicle, appeared as avantguardist in the early seventies. Without mentioning the thyristor drive with recovery, research in the field of materials (cast aluminum alloy bodies, usage of reinforced plastics) led to the creation of an 840 kg vehicle, that is, 170 kg less than the electricity-adapted Renault 4 EdF and 210 kg less than the Renault-Tregie delivery truck, 1979 prize winner. This is a noticeable savings when it is known that 10 percent of increased weight correspond to 30 percent less range. In addition, with adapted suspension, steering and wheels, the range of the CGE Gregoire attained 62 km in very heavy city traffic, 85 km in normal city traffic and 100 km on the highway. Performances which would be 30 to 50 percent better by using the latest technical improvements.

Therefore the development of an individual electric car depends at the same time on technical progress and on the will of the public and industry to promote such a transportation method, itself resulting from energy problems. The GIVE competition will open up a pilot operation that will permit 100 vehicles to circulate in 5 or 6 cities of France.

Mass Transit Involved

But, it is certainly in the field of mass transit that the projects have the chance of succeeding fast. Many prototypes are being manufactured. Such is the case of a 150-seat bi-modal articulated t olley bus. Two and 1/2 tons of 160-Ah nickel-cadmium batteries, with a 400 W/kg specific power will allow attaining a range of 4 to 5 km with a 20-percent depth of discharge. These batteries, which are recharged in action, will limit feeding through wires to the ends of the lines on the common main lines of the system. On this prototype, a current cutter--which replaces the starting rheostat still present on the ER 100 Berliet--will deliver continuous starting voltage.

A 28-seat city minibus is also "in the works." With 800 kg of 100 Ah nickel-cadmium batteries rechargeable in 3 minutes (discharge depth limited to 35 percent), it will have a 3 to 4 km range. This new bus, the fruit of efforts by Tregie and RVI, should be shown in the coming transportation Expo 80, like the bimodal trolley. The city of Tours will doubtlessly benefit by a demonstration of this vehicle, while the cities of Lyon, Marseilles, Saint-Etienne, Grenoble and Limoges will be involved with the articulated trolley. The advantages of the latter (less energy expense, decreased pollution, continuous acceleration, improved comfort), should compensate, once the poling problem is solved, the 15 percent in increased cost (including investments and exploitation) which affect the bi-modal in comparison with the conventional system.

In the short run, it is therefore probable that the electric vehicle will establish itself in mass transit (nickel-cadmium batteries) and in the delivery field (lead batteries). But at the level of individual transportation, it will still remain for a long time a complement to the thermal engine car.

Manufacturer's Opinion

"A battery is like a human being. It is fed, works, heats up, has a memory and can be sick. We must therefore treat it as such." Daniel Legrand knows the subject well. Responsible for the Electric Vehicles Section at Fulmen (CEAC), he is also the leader of the "component" group at Avere (Association for Highway Electric Vehicles). He is also one of the creators of the CGE Gregoire. For him, "the thermal 'electrified' vehicle will be the first to appear on the market. But a real electric car requires total rethinking." Like the CGE Gregoire, several examples of which are still circulating after 10 years.

With the petroleum crisis, Fulmen has tried to introduce some trump cards into its game. Its Vierzon factory is capable of responding to a large-scale demand for electric-vehicle batteries.

The Researcher's Point of View

At the Transportation Research Institute, Bertrand Dupont expects a lot from the bi-modal articulated trolley bus and the electric bus. The first one should find its place in 5 cities that already have a pool of conventional vehicles (430 units among all 5). "What appeals to the municipalities is mainly the passenger capacity thanks to articulation. But the batteries life (30,000 cycles) and the elimination of cables and posts in the city's center will weigh heavily on the decision to invest," he said.

As for the electrification of the minibus network in the city (the case of the city of Tours has been studied with the SL 25 prototype), "it involves an average increase of 9.2 percent in the overall exploitation bill. The electric bus is therefore far from utopic."

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TMI-FOREST BUILDS GIANT MILLING MACHINES

Paris L'USINE NOUVELLE in French 17 Apr 80 p 99

[Text] Fifty-two trucks will soon set out on the road that runs from the TMI-Forest factory at Capdenac (Aveyron) to the Dassault de Seclin factory in the North department. An extraordinary convoy for two machines which are certainly the largest milling machines in the world. Presently, the TMI-Forest engineers are making the last adjustments before the final check and control of the machines, which will then be dismantled for delivery. Once delivered, it will take another six months to set them up and adjust them again.

The first of these machines, the V6 2000 2T, has a 17 meter capacity and a 23 meters long bench. There is a space of 7 meters between beams which support 6 22kw spindles which swivel on 5 axes with an inclination of ± 30° for the A axis and ± 45° for the B axis, a characteristic unique to this machine. In all, 14 axes will be driven by numerical command. In comparison, according to Robert Vitrat, commercial director of TMI-Forest, the most perfected American machines do not have more than a 5 meter clearance between beams and 3 heads with 5 axes.

The V6 6000 aT will mainly be used by Dassault for machine-finishing the mirage 2000 and 4000 framework. Six frames can be machine-finished at the same time.

The other machine, the V8 H4 6000 R, is even bigger. It has a 36 meter long bench for a 30 meter capacity, 8 30kw spindles, positioned on each side of the cross-bar. This machine can finish eight wing sides at the same time, sides which can used either for the Mirage or the Airbus.

Japanese and Italian Licenses

For TMI (Industrial Mechanics and techniques), this is a great birthday present. Just a year ago this company had taken over both the functions and the factory of Capdenac de Forest when the Ratier-Forest-GSP group declared itself insolvent. TMI, which employs 500 people, should realize a total sales worth 180 million francs in 1980. It has five major lines of production: aeronautical machines; large boring-milling machines, cross-bar milling machines, high capacity machine-finishing areas (more than 1m^3 capacity) and special machines for ship, turbine, and airplane propellers.

TMI has given licenses to the Japanese firm Toshiba and the Italian firm Saimp, which will both manufacture Boeing 767 finishing-machines under the Forest name. Other agreements have been made with Spain, Hungary, Romania and recently, with the People's Republic of China.

Currently, the plants are in full production to meet past contract agreements with Great Britain, India, the People's Republic of China and the Eastern European countries. Management's goals for the near future include the installation of a manufacturing plant in the United States and a commercial arm in Brazil, and also, in France, buying the Capdenac factory in Forest, presently being rented, and the enlargement of the assembly areas.

A CAO System To Reduce Delivery Time

To give them the means with which to carry out thier projects, the heads of TMI have decided to equip their research offices with a computerized conception system. This would be the first European machine and tool company to take such a step. This CAO system, which would be furnished by the American company Computer Vision, can display mechanical drawings, assembly and reassembly plans, as well as electric and hydraulic systems as a 3-D image. Eight interactive graphic psots are linked to this system, which will increase the innovative capacities of the research department considerably, since it will no longer need to perform repetitive tasks. An enormous amount of time will also be saved by the engineer and technicians. This is an important plus when one realizes that during sales negotiations, delivery time is often the deciding factor.

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USE OF COMPOSITE MATERIALS IN OFFSHORE TECHNOLOGY PLANNED

Paris SEMAINE DE L'ENERGIE in French 24 Mar 80 p 2

[Bordeaux, from our special correspondent Yves Naudin]

[Text] "High performance composite materials are going to be widely used in the near future." In the opinion of Jean-Remy Hugues, head of the Aquitaine Plant of Aerospatiale, these materials will become increasingly indispensable in the automobile, aeronautical, or even medical industries, replacing metal parts.

The Aerospatiale Balistics and Spatial Systems Division, which devotes 95 percent of its activities to the deterrent force, has undertaken these past few years a policy of diversification aimed at offering its competency in high performance composite materials to other industrial sectors, which are always on the lookout for profitable innovations.

This "new horizon" research has recently been manifested in offshore technology. At the beginning of 1979, the Aerospatiale Balistics and Spatial Systems Division and the French Petroleum Institute signed a collaboration convention which bore fruit after 1 years time with the first positive test of deepsea drilling pipe made out of composite materials.

Two series of pipes for vertical linking, made of glass or carbon wire, have been perfected. But their properties are just as impressive: 3 and 4 times lighter than steel, great resistance to corrosion, and for working pressures of 350 bars with a safety factor of 3.

Being very flexible, these pipes should make it possible, when drilling in 1,000 meter-deep water, to appreciably reduce exploitation costs. Presently, studies are progressing satisfactorily for the perfection of connections between the pipes.

But the "intrusion" of Aerospatiale in the offshore petroleum field does not stop there. The Aquitaine Plant has already produced, again in composite filament material, high pressure gas bottles (over 1,000 bars on breakage) for diving, which again feature lightness, safety, and natural resistance to corrosion.

These various materials were originally conceived and manufactured to meet the specific needs of the aerospace industry. But there is nothing to prevent the French Petroleum industry, also in the vanguard, to benefit from this experience. Also, the combination of the perfectionism of Aerospatiale engineers and the pragmatism of the oilmen should result in new applications, in the years ahead, at an increased rhythm.

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FRANCE

METHOD OF PRODUCING HYDROGEN BY ELECTROLYSIS DEVELOPED

Paris L'INDUSTRIE DU PETROLE GAZ-CHIMIE in French Mar 80 pp 81-83

[Article by Catherine Kuylaars]

[Text] For several years now the theme of hydrogen, an energy vector, has been bandied about. A large research program has been launched, with the support of the DGRST [Delegation Generale a la recherche scientifique et technique], to explore all avenues making possible the production of this gas, which today is present in limited quantities on the market, by using energy lost during off-peak hours in nuclear reactors. Currently, the "electrolysis" avenue seems about to discover a commercially profitable solution: prototypes are being developed, but still in laboratory research.

Hydrogen today is only used, chiefly as a chemical reagent, principally for the production of ammonia, in hydrocracking processes, iron production through ore reduction, gas production from petroleum products or coal. However, the development of the French nuclear program has led public authorities to consider another aspect of the use of this gas, which would become an energy vector, its properties making its storage and distribution easy.

The operation of nuclear reactors offers in fact the peculiarity of furnishing continuous production of electricity, or production which, in any event, is difficult to modify to meet demand. This expalins why certain research and development work aims at utilizing, in every way possible, the electricity produced during off-peak hours, the heat associated with cooling circuits, etc.

Among the subjects under study in this context, the production of hydrogen (and oxygen) by electrolysis, that is to say, the decomposition of water by means of an electrical current occupies a choice place.

Why electroylsis? Because indeed, this process, in truth very expensive since it uses one of the noblest forms of energy, electricity, could become economically feasible there: the electricity used is in any event surplus electricity. And also because, unlike the thermochemical production of hydrogen, it is an avenue which seems destined to result in satisfactory technical solutions.

As for hyrdogen, it represents, on the supposition of mass production, a great flexibility of application on the energy market: from the energy point of view, it is the equivalent of natural gas, and, by extension, of oil. The following uses can be found for it:

--for home furnances and small industries: home and industrial heating as a substitute for natural gas;

--in transportation: supersonic transport, automobile propulsion, by heat engine or by battery, heavy turbine transport, etc;

--in electricity production: fuel fired stations.

Many problems relative to storage, distribution and substitution have obviously to be worked out (how, for instance, can burners be adapted?)

But electrolysis in off-peak hours ought to make it possible to regulate the production of electronuclear energy, providing however progress be made on output and cost. Are we going to move, concurrent to the combined production of heat and electricity, towards the combined production of hydrogen and electricity?

The thermochemical avenue (hydrogen production by decomposition of water near a high temperature nuclear reactor) seems for the time being "more myth than reality." But research on production by electrolysis, based on the development of an improved electrolyser, is presently on going.

These efforts have been carried out for several years (since 1976) with the support of the European Community Commission and the DGRST. The industrial enterprises of the CGE [Compagnie Generale d'Electricite] group are also involved: the ACB, the CFEE [Compagnie Generale d'Entreprises Electriques, Levallois]-Alsthom and SAFT [Societe Accumulateurs Fixes et de Traction, Romainville]. Study, research and experiments are carried out in the laboratories of Marcoussis (research center of General Electric) and of Alsthom-Atlantic (Neyrtec). Research is orientated in two directions which ought to make off-peak hour electrolysis economically feasible, by lowering exploitation and investment costs. They aim at:

--increasing the density of electrolysis current, in order to increase the installed constant load power;

--simultaneously lowering overall operating voltage, with a view to lowering specific consumption.

At constant intensity the lowering of overall voltage may be obtained by:

--increasing working temperature: for different reasons one has been led to adopt a temperature around 120C;

--lowering the electrode overvoltage by using catalysed electrodes;

--limiting chemical cell drops by the use of new metalico-plastic dividing plates.

For economic reasons and also in order to limit chemical drops, the Marcoussis electrolyser is conceived to operate under a pressure close to 30 bars, with the electrolyte circulating.

In existing industrial devices, current density is 2,000 A/m^2, and voltage on the 2 V order; specif consumption is 4.8 kWh/Nm^3 of H^2.

Work actually in progress holds out the possibility of constructing electrolysers operating with a current density of 10,000 A/m^2 and a voltage lower than 1,8 V, for a savings of 10 percent on specific consumption.

Furthermore, investment costs of these new types of electrolysers will be appreciably lowered: 700 F (eventually) per installed kW for the new process against 1,600 F for existing processes (1977 value).

We are nearing then industrial recommendations which aimed, in 1976, at introducing by 1985 the first industrial installations. There must be developed at the same time hydrogen transportation networks, tests of high capacity storage, of supplying industrial installations in siderurgy, chemistry, refining.

Perhaps one day there will be more talk of the most audacious applications, like a hydrogen-powered car (a prototype exists in the United States). And lastly, to close the circle, we will see the spread of hydrogen-powered reactors for the traction and decentralized production of electricity. Hydrogen will then play its full role as energy vector.

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PRODUCTION, USE, EXPORT OF INDUSTRIAL ROBOTS DISCUSSED

Stockholm SVENSKA DAGBLADET in Swedish 15 Apr 80

[Article by Christer Berglund: "Robot Still More Effective"]

[Text] Digitally guided machines, so-called NS [from the Swedish for "digitally guided"] machines have, ever since the sixties, accounted for an increasingly larger proportion of industrial production in Sweden.

One NS machine, for example, can stamp out different shapes in sheet metal. From 1972 to 1977 production of NS machines increased almost twice, from 9 percent of total industrial production in 1972 to 17 percent in 1977.

During the later part of the seventies the increase in the number of NS machines has leveled off. Instead they have become computer guided with increased capacity. Today an NS machine has the same capacity as two or three conventional machines.

Where earlier a worker would place the work pieces in the machine, now more and more often a robot stands there instead. It is predicted that the eighties will be the decade of the robots. (Which the seventies did not turn out to be, in spite of similar predictions.) But only during the second half of the eighties will robots with ocular, auditory, and tactile sensing be common.

It's still the large companies that use the largest proportion of robots in Sweden. ASEA [Allmanna Svenska Elektriska Aktiebolaget], Volvo, Electrolux, and Sandvik use 55 percent of the number of robots in Sweden. In West Germany more than 300 robots were working in 1977, in Sweden about 500.

On the other hand, Sweden lags behind in general electronic development. West Germany is the only European country to go in for electronic development in all areas.

Japan produces about 50 percent of the robots used today. But Sweden, too, produces robots for export. ASEA, which is the largest in this field in Sweden, sells 80 percent of its production abroad.

Production, import, export, and inventory of industrial robots in Sweden up to 1979

					Prognosis	Total
Up to	1975	1976	1977	1978	1979	Number and Value
Domestic production						
Number	540	150	275	315	460	1,740
Value, million kronor	47	29	58	73	102	309
Export						
Number	85	65	120	190	245	705
Value, million kronor	10	14	29	50	59	162
Import						
Number	120	15	25	40	54	254
Value, million kronor	20	4	7	12	15	58
Inventory						
Number	575	100	180	165	269	1,289
Value, million kronor	57	19	36	35	58	205
Export quota (value) %	21	48	50	68	58	52
Import quota (value) %	35	21	19	34	26	28

Source: Data--Och Elektronikkommitten (Committee for Data and Electronics)

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BRITISH WAVE-ENERGY PROGRAM DESCRIBED

Frankfurt/Main FRANKFURTER ALLGEMEINE BLICK DURCH DIE WIRTSCHAFT in German 30 Apr 80 p 5

[Article: "British Researchers Flirt With Use of Wave Energy"]

[Text] In the state promotion of nonnuclear energy research, Great Britain is focusing on the use of the wave energy of the sea. This is comparable only to the efforts in Japan, where wave-energy use is also considered to be a key issue. A new publication from the English Ministry for Energy ("Wave Energy," Energy Paper No 42, MHSO, London, 1979) contains a report on the status of measures for the use of the wave energy of the sea through research efforts by the English government.

The possible use of the waves of the sea has always been pursued with interest in Great Britain. According to the figures in the report several hundred patents for wave-energy use have been applied for in Great Britain in the last 100 years. However, the interest on the part of the government did not start until after the 1973 oil crisis, based on a report about the routes to be taken by the English government in respect to Great Britain' energy policy. At first, a two-year program was started, and on the basis of the results achieved efforts have been continued to the present on an expanding basis.

The English research program has three main goals: development of several different designs to convert wave energy, support of research in the appropriate scientific and technical areas, and development of reference plants for the large-scale technical use of wave energy.

In order to achieve this, various wave-energy converters were developed and laboratory tested in the first phase. At the same time an extensive study of wave-energy motion was initiated in connection with the seas around Great Britain. Due to the measures to date substantial progress has been made. But in assessing suitable wave-energy power plants, the key problem in all studies of wave-energy use centers on designing relatively simple wave-energy converters in order to convert the power of the waves into a usable form of energy. The difficulty here consists in the fact that the wave energy, determined by the height of the wave and also by the rhythm, puts great demands on the converter system.

An inventory of the possible use of wave energy in Great Britain has thus far been done on the basis of wave-energy measurements: it turned out that 70 MW per km of wave length can be obtained using familiar converter systems in suitable regions, that is, primarily in the Hebrides. Of course, wave energy accumulates day and night, which is the opposite of direct solar radiation. In respect to the seasons, it is at a minimum in the summer and reaches its maximum in the winter. This seasonal course of wave energy is of interest for power production precisely because current consumption is likewise highest in the winter and lowest in the summer. To date a number of converters have been tested. Cooperation with several Western industrial countries is in progress; an exchange of experience is taking place in particular with Japan. In the case of the Kamei project, which was promoted by the International Energy Agency, an English converter plant is also being tested. At present international cooperation is limited to Japan, the United States, Canada and Ireland, although recently Norway also announced its interest in becoming involved. In the report mentioned it is, of course, emphasized that, given today's conditions and today's findings, wave-energy use to generate electricity is still not economical as compared with nuclear energy or conventional power plants, but that the government feels that this form of obtaining energy should be kept in mind.

On the basis of the data obtained so far concerning wave energy around Great Britain, it has become apparent that the west coast of Great Britain is of primary interest. But also several parts of the east coast, particularly Scotland, come into question for wave power plants. However, in addition to the development of the wave-energy converters, considerable importance also attaches to transporting wave energy to consumption centers. In this connection, various systems have been studied. Starting with the conversion of wave energy into electricity, transmitting the electricity via a flexible line to a platform, and from there to the coast and on to systems in which, with the help of electrolysis, hydrogen is produced and hydrogen is used to transport energy. But at the same time great importance is also accorded to desalination of sea water using wave energy. But this might be of less interest in Great Britain because the problem of a limited water supply does not arise there.

A first start at judging the economic efficiency of wave energy was already tested. The starting point was a reference plant of 2,000 MW, using familiar technologies as a basis. Capital costs are also decisive for wave power plants. Whether the wave power plants are built near the coast or quite far from the coast depends on a very great degree on the design of the plants used. In terms of the present state of affairs, however, wave energy cannot be considered as an alternative in Great Britain's energy policy. And precise statements about costs are also not possible because research and development have not yet progressed far enough.

But studies about the effects of a system of large wave power plants on the environment are interesting, especially as put forth in a study about the use of wave energy in the Hebrides. In this connection one result is interesting: a wave power plant removes energy from the waves off the coast. For example, a wave power plant in 20 m of water, which is still functional during a storm with a windspeed Beaufort 7, would reduce wave height of 5.9 m to 4.6 m (average value). Thus, a chain of large wave-energy power plants along the coast would result in decreasing the force of the waves overall along the coast. Corresponding effects can then be anticipated along the coast. For example, the situation with respect to the summer and winter beaches in Scotland would change. But the extent depends on the distance at which the wave power plants are built from the coast. Taking the picture as a whole, the positive effects far outweigh several negative ones. But it is strongly dependent on the respective location of the chain of wave power plants. Generally, researchers in English are optimistic in respect to the future potential of wave energy; however, in this regard, large-scale technical use would no doubt not take place until the turn of the millenium.

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SELECTIVE LIST OF JPRS SERIAL REPORTS

WESTERN EUROPE SERIAL REPORTS

WEST EUROPE REPORT
WEST EUROPE REPORT: Science and Technology

WORLDWIDE SERIAL REPORTS

WORLDWIDE REPORT: Environmental Quality
WORLDWIDE REPORT: Epidemiology
WORLDWIDE REPORT: Law of the Sea
WORLDWIDE REPORT: Nuclear Development and Proliferation
WORLDWIDE REPORT: Telecommunications Policy, Research and Development

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